

Remarks

The Office action mailed August 24, 2006, has been reviewed and carefully considered. Claim 1 has been amended to incorporate the subject matter recited in dependent claims 2, 3 5 and 6, now canceled. Claims 8-11 have been canceled without prejudice toward filing a divisional application. New claims 12-16 have been added. Entry of these amendments is respectfully requested.

Claims 1-7 were rejected under 35 U.S.C. §103 over Muradov (U.S. Patent No. 6,653,005). Claim 1 is directed to a system that includes a fuel mixture that includes steam, hydrogen and optionally at least one hydrocarbon fuel, wherein steam and hydrogen are present in proportions of no more than 1.5 moles of steam per mole of hydrogen or the molar ratio of steam to hydrocarbon fuel in the mixture is no greater than 1.5 to 1. Similarly, the method of new claim 16 involves introducing into the anode inlet a fuel mixture that includes steam, hydrogen and optionally at least one hydrocarbon fuel, wherein steam and hydrogen are present in proportions of no more than 1.5 moles of steam per mole of hydrogen or the molar ratio of steam to hydrocarbon fuel in the mixture is no greater than 1.5 to 1.

As noted above, according to claims 1 and 16 the fuel mixture supplied to the anode inlet includes steam. In the Muradov system a pure hydrogen feed stream is introduced into the anode inlet (i.e., there is no steam in the anode inlet feed stream). In particular, Muradov stresses in several instances the necessity of a pure hydrogen feed stream. For example, column 6, lines 54-67, state that the hydrogen gas fed directly into the fuel cell is produced via decomposition of hydrocarbon fuels in the presence of catalytic materials in an oxidant-free environment according to the equation shown at column 6, line 67. Note that no water is produced according to this equation. Column 7, lines 4-7 refer to the “lack of oxidizers (air and/or water) in the reactor during hydrocarbon decomposition.” Column 7, lines 44-45, emphasize that “high purity hydrogen is fed to the anode compartment.” Thus, Muradov would not have suggested including steam in the mixture introduced into the anode inlet of the Muradov system.

In addition, Muradov fails to describe any mole or molar ratio for any components of the gaseous mixture introduced into the anode inlet of the Muradov system, much less those specified in claims 1 and 16. Despite this critical gap in the knowledge to the art imparted by Muradov, the USPTO's position on page 3 of the Office action is that such features would have been "obvious to optimize . . . where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art." However, applicants' discovery was not "optimization" of "general conditions" known in the art.

As explained on page 9, lines 24-27, of the present application "in fuel cell systems of the prior art, substantially higher (such as 5 moles steam/mole carbon for example) concentrations of steam are used to avoid carbon deposition with conventional anode materials, and/or in systems without the benefit of enriched hydrogen recycle." The Background section of Muradov itself demonstrates that conventional practice in the field of fuel cell systems utilized, for example, "2-4 moles of steam per mole of carbon in the fuel" (column 2, lines 60-63) or "a steam/methane weight ratio of 3/1 to 5/1 was required to operate the reactor" (column 3, lines 10-12). In contrast, applicants' system and method goes against conventional wisdom in the field by employing a fuel mixture with significantly higher amounts of hydrogen or hydrocarbon fuel relative to the amount of steam. Applicants discovered that such ratios could be achieved by utilizing certain selective materials. And unlike the Muradov system that employs pure hydrogen as the anode inlet feed, steam constitutes at least a portion of the anode inlet feed in applicants' invention.

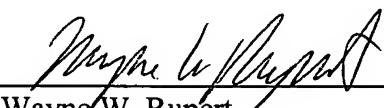
Hence, the "general conditions" known in the art, in fact, taught away from the system of claim 1 and the method of claim 16. Moreover, optimization of such "general conditions" known in the art would have led to more precise tuning of steam/fuel ratios that would have been significantly higher than those presently recited. Viewed another way, there would have been no reasonable expectation that optimization of the known steam/fuel ratios would have resulted in ratios that are at least 50% lower than the known ratios.

It is respectfully submitted that the present application is in condition for allowance. Should there be any questions regarding this application, Examiner Martin is invited to contact the undersigned attorney at the telephone number shown below.

Respectfully submitted,

KLARQUIST SPARKMAN, LLP

By



Wayne W. Rupert
Registration No. 34,420

One World Trade Center, Suite 1600
121 S.W. Salmon Street
Portland, Oregon 97204
Telephone: (503) 595-5300
Facsimile: (503) 595-5301